

species. This is probably a result of natural selection against deleterious genes during the repeated inbreeding of its evolutionary history.

In soybean, the aforementioned experimental evidence clearly shows that given the proper genetic combinations, high parent heterosis occurs. It is not known how much of the heterotic effect is due to dominance and dominance types of epistasis and how much could be due to additive \times additive epistasis. Presumably, a homozygous line with performance equal to the F_1 could be selected from segregating generations. The probability of finding such a line, however, would be influenced by the number of genes involved and the relative importance of dominance effects, which cannot be fixed, and additive \times additive effects, which can. A homozygous line equal in performance to a heterotic F_1 might be quite difficult and expensive to identify if a large number of genes influence the trait and if dominance and dominance types of epistasis were significantly involved.

Currently, an economical way to produce F_1 hybrid seed in soybean for farm use does not exist. Additional research with various sources of male sterility may lead to the development of an economical method. In that event, it would be useful to know which hybrid combinations would be the most productive. Bailey et al. (1980) have described a design, using the F_2 and backcross generations to predict heterosis, that might be an economically useful way to test parental combinations. Burton and Carter (1983) have described a method for producing experimental quantities of F_1 hybrid soybean seed. This method involves the development of genetic male-sterile maintainer lines with the green cotyledon trait ($d_1d_1d_2d_2$) for use as female parents. Any yellow-seeded cultivar which flowers synchronously with the female parent can serve as the male parent. Additional research is needed to produce estimates of heterosis for a wider array of genotypes under commercial cultural conditions and to develop more information on the environmental stability of F_1 hybrids relative to pure lines. Such research will provide a better assessment than now exists as to the economic advantages or disadvantages of F_1 hybrids relative to pure lines.

6-3 HERITABILITY

Heritability is usually defined as the proportion of total or phenotypic variance for a given trait, that is strictly due to genetic variation. Hanson (1963) stated that heritability estimates serve two purposes in plant breeding. First, they show the relative ease with which different traits are selected under a given testing regime. Thus, it is often noted that percent protein is more highly heritable than seed yield. The other purpose for heritability estimates is prediction of selection progress. The change in population mean (ΔG) due to selection is a function of heritability (h^2) and the selection differential S .